

METALLURGICAL TESTWORK -

(GTE) METALLURGY - CYPRUS COLUMN-
CYANIDATION STUDY 1977

CYPRUS RESEARCH COMPANY

INTEROFFICE CORRESPONDENCE

To J. Worthington

DATE 7/27/77

FROM D.L. Harris

FINAL REPORT

SUBJECT Column Cyanidation Gold Ore,
Gilt Edge No. 2

77-0061-EXP

The data for the column leaching by cyanidation of Sample Gilt Edge No. 2 were reported June 8, 1977 with the exception of the leached residue analysis (tailings) for gold. A final gold recovery value is noted as follows based on cyanide extraction data and tails assay.

Analyses:

Heads Analysis, calculated	0.247 oz/t
Tails Analysis,	0.03 oz/t
Au, Recovery	87.9 %

In table I, data for Gilt Edge Tests No. 1 and No. 3 have been reported on a similar basis as for Test No. 3 for comparison. The calculated "Heads", based on cyanide extraction of Au and the tails assays have been noted and the percent of Au extracted has been correlated to the calculated "Heads".

DWIGHT L. HARRIS
DLH/bb

TABLE I
CYANIDATION DATA

Ore Sample	(2)	Au	(1)	(1)	Days Leached	Reagent	
	Au Assav Heads oz/t	Au Assav Residue oz/t	Au Cyanide Extraction %	Au "Calc" Heads oz/t		Lime lb/t	NaCN lb/t
G.E. 1	-	0.02	54.8	0.044	26	1.5	4.6
G.E. 2	(0.27)	0.03	87.9	0.247	64	5.34	12.3
G.E. 3	-	0.016	77.5	0.068	26	0.8	4.9

(1) Cyanide-extracted Au plus Au in tails used to calculate heads.

Heads Assay: Au, oz/t

(2) Heads assays were not representative due to lack of sample material - there was too little ore sample to permit splitting a representative sample before column leaching. It was decided to depend on solution cyanide assays, and residue assays to calculate the heads assays.

The column leach daily reports were calculated for Au recovery on a "Heads" basis which in several cases were substantially different from the calculated "Heads".

Residue Assay: Au, oz/t

G.E. 1	.042	
	.02	
	.02	
	.02	ave = 0.02 oz/t
G.E. 2	.032	
	.032	
	.026	ave = .03 oz/t
G.E. 3	0.016	
	0.016	
	0.016	
	0.016	ave = 0.016 oz/t

TABLE II
SCREEN ANALYSES

Screen Size	G.E. 1		G.E. 2		G.E. 3				
	Heads %	Residue %	Heads %	Residue %	Heads %	Residue %			
+3/8 inch		5.8		15.7		12.0			
+10 M - 3/8		53.6		68.2		67.3			
+28 M - 10 M		19.6		10.3		11.9			
+60 M - 20 M		8.9		3.0		3.2			
+100 M - 60 M		4.3		1.3		1.5			
+200 M - 100 M		3.1		1.1		1.3			
- 200 M		4.5		0.6		2.7			
- 325 M		-		1.8		-			
Weight	29.74 Kg		29.7 Kg		28.6 Kg		28.3 Kg	28.68 Kg	29.5 Kg

CYPRUS RESEARCH COMPANY

INTEROFFICE CORRESPONDENCE

To J.E. WORTHINGTON
 FROM D.L. HARRIS

TO	REPLY	
<i>JEW</i>	COMMENT	
RETURN TO		
DATE	JUN 10 1977 June 8, 1977	
1	5	
2	6	
3	7	
4	8	

SUBJECT Weekly Progress Report
Week Ending 6/04/77
Project No. 77-0061, Gilt Edge No. 2
Project No. 77-0141, Haile No. 10 and 15.

1. Tentative gold recovery after 64 days of cyanidation in Gilt Edge No. 2 amounts to 81.4 %. The cyanidation test has been ended.

Reagent consumption is calculated to be:

NaCN	12.33 lb/t
Lime Dry	4.5 lb/t
Solution	0.84 lb/t

2. Gold recovery for Haile samples DDH No. 10 and DDH No. 15, after 26 days of cyanidation is noted and the tests have been ended.

Haile No. 10	50.16 %
Haile No. 15	76.1 %

Reagent consumption is calculated to be:

	<u>No. 10</u>	<u>No. 15</u>
NaCN	4.35	4.81
Lime		
Cyanide Soln.	0.119	.139
Start up dry	1.08	0.97

3. The tests have been completed on the three ore samples. Cyanidation was stopped on June 3, 1977 and lime wash water was continued for two days.

The columns were allowed to drain for two days and now will be dismantled. The leached ore samples will be dried split for screen analysis, and sampled for gold analysis.

4. The gold analysis of the carbon column, used for the cyanide recycle solutions for Haile No. 10 and No. 15 will be obtained for further information.

D.L. Harris
 D.L. HARRIS
 DLH/bb

cc: ESA, AAB, CAM, DLH, FILE

COLUMN LEACHING
TEST DATA

PROJECT NUMBER: 77-0061 SAMPLE Gilt Edge #2 CHARGE: 28.61 Kg
DMO Oxidized 63.05 lb.

ANALYTICAL BALANCE:

PRODUCT WEIGHT/VOLUME AU ASSAY CONTENT DISTRIBUTION
REAGENT SOLUTION
ATTACHED RESIDUE

AD (CALCULATED):

AD (ASSAYED) : CRC's 2nd set of assays after finer grinding 0.270 g/lt Au
Hence, Gold values in the leached sample = 851.68×10^{-5} troy oz.

REAGENT CONSUMPTION:

DATE	VOLUME LITRE	PH OF SOL.	NACN:			LIME:		EXTRACT. OF GOLD	CUMM EXTRN	16/ton	
			SOLUTION AU	ASSAY CN	(MG/L) CAO	AU RECVD TROY OZ	REAGENT CYANIDE CN			CONS. LIME CAO	
-29			64.0g of CaO was added in the dry form								4.47
-30	6.86	12.34	-	-	306						
			CYANIDE WAS ADDED IN THE CIRCUIT								
-31	5.86	12.10	1.38	127	336	25.96×10^{-5}	3.05	3.05	.165	-.117	
1-1	7.24	11.46	3.22	354	396	74.83×10^{-5}	8.79	11.84	.09	-.175	
4-2	7.48	11.32	2.82	391	209	67.71×10^{-5}	7.95	19.79	.07	-.08	
4-3	7.38	11.26	2.30	389	95.1	54.49×10^{-5}	6.40	26.19	.073	-.023	
4-4	7.76	11.29	2.00	398	54.2	49.82×10^{-5}	5.85	32.04	.072	-.002	
4-5	7.50	11.13	1.62	398	27.6	39.00×10^{-5}	4.58	36.62	.070	.012	
4-6	7.50	11.13	1.28	389	18.6	30.80×10^{-5}	3.62	40.24	.075	.016	
4-7	7.86	11.04	1.14	407	16.8	22.76×10^{-5}	3.38	43.62	.069	.018	
4-8	7.36	11.16	0.96	372	30.7	22.68×10^{-5}	2.66	46.28	.082	.01	
4-9	8.60	11.11	0.82	389	24.7	22.64×10^{-5}	2.66	48.94	.086	.015	
4-10	6.66	11.05	0.66	336	12.5	14.11×10^{-5}	1.66	50.60	.091	.017	

GLE H2 Level Data Continued

16 / 700

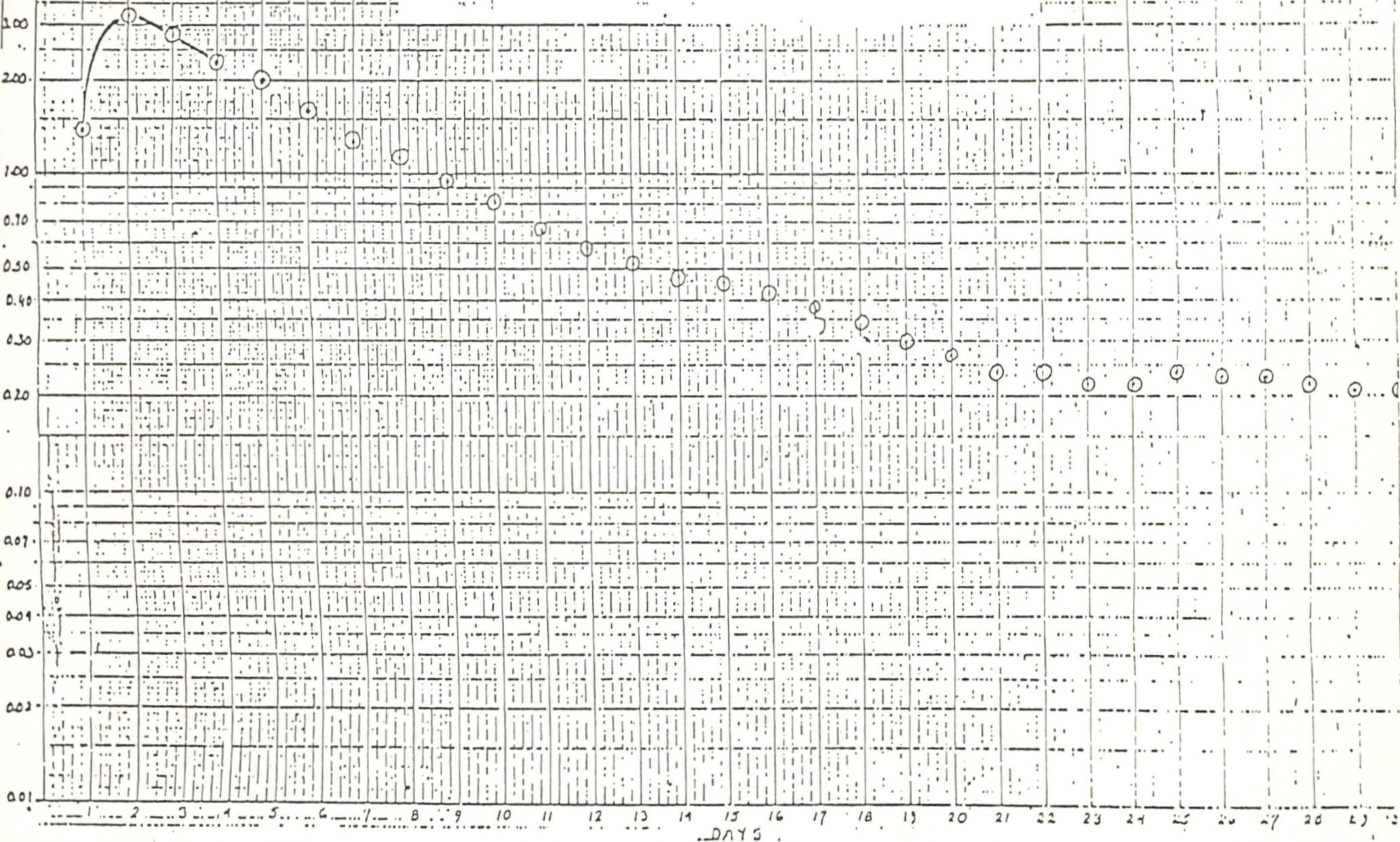
E	VOLUME LITRE	PH OF SOL.	SOLUTION ASSAY (MGL)			AU RECVD TROY OZ	Σ EXTRACT. OF GOLD	CUMM EXTRN	REAGENT	CONS.
			AU	CN	CAO				CYANIDE	LINE
								CN	CaO	
1	8.05	10.92	0.58	310	13.9	14.99×10^{-5}	1.76	52.36	.124	.020
2	7.00	10.92	0.52	310	9.9	11.68×10^{-5}	1.37	53.73	.108	.020
3	7.50	10.87	0.48	301	9.9	11.56×10^{-5}	1.36	55.09	.121	.021
14	8.16	10.87	0.46	292	8.7	12.05×10^{-5}	1.41	56.50	.137	.023
15	7.10	10.84	0.42	292	10.7	9.57×10^{-5}	1.12	57.62	.119	.019
16	8.00	10.87	0.38	292	15.7	9.76×10^{-5}	1.15	58.77	.134	.019
17	7.74	10.83	0.34	301	4.9	8.45×10^{-5}	0.99	59.76	.125	.024
18	7.00	10.82	0.30	319	7.8	6.74×10^{-5}	0.79	60.55	.104	.026
19	7.00	10.87	0.28	319	10.4	6.29×10^{-5}	0.74	61.29	.104	.019
20	8.00	10.86	0.27	319	7.3	6.93×10^{-5}	0.81	62.10	.119	.024
21	7.46	10.81	0.24	319	12.8	5.75×10^{-5}	0.68	62.78	.111	.019
22	7.52	10.79	0.24	310	12.2	5.79×10^{-5}	0.68	63.46	.117	.026
23	7.50	10.78	0.22	301	11.0	5.30×10^{-5}	0.62	64.08	.121	.020
24	7.50	10.80	0.22	363	11.0	5.30×10^{-5}	0.62	64.70	.088	.020
25	7.50	10.91	0.28	363	9.6	6.74×10^{-5}	0.79	65.49	.088	.021
26	7.30	10.87	0.26	381	9.3	6.09×10^{-5}	0.72	66.21	.077	.02
27	7.94	10.83	0.26	336	11.9	6.63×10^{-5}	0.78	66.99	.109	.02
28	7.50	10.81	0.24	336	11.0	5.78×10^{-5}	0.68	67.67	.103	.02
29	7.46	10.74	0.22	336	11.0	5.27×10^{-5}	0.62	68.29	.103	.02
30	8.10	10.83	0.22	336	7.3	5.72×10^{-5}	0.67	68.96	.111	.02
1	8.00	10.79	0.22	345	7.3	5.65×10^{-5}	0.66	69.62	.104	.02
2	6.34	10.68	0.22	336	7.3	4.48×10^{-5}	0.53	70.15	.087	.015
3	7.06	10.72	0.20	345	4.6	4.53×10^{-5}	0.53	70.68	.092	.02

CYPRUS

PROJECT NO. 77-0061 SAMPLE Gilt Edge #2

COLUMN LEACH - CYANIDATION TEST DATA
HEAD ASSAY

LEACH SOLUTION ASSAYS VS DAYS



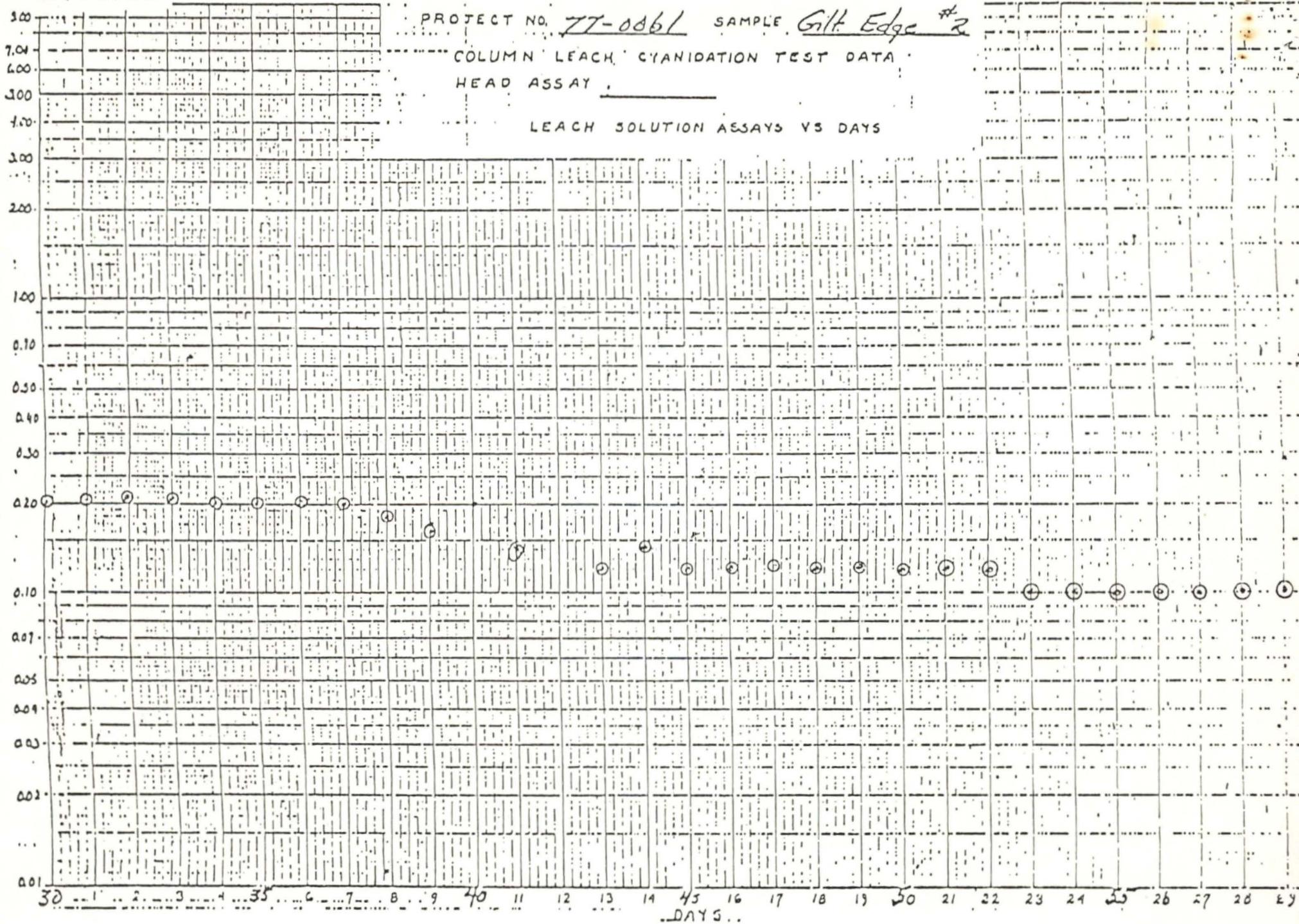
CYPRUS

PROJECT NO. 77-0861 SAMPLE Gilt Edge #2

COLUMN LEACH CYANIDATION TEST DATA
HEAD ASSAY _____

LEACH SOLUTION ASSAYS VS DAYS

LEACH SOLUTION ASSAYS - g/L



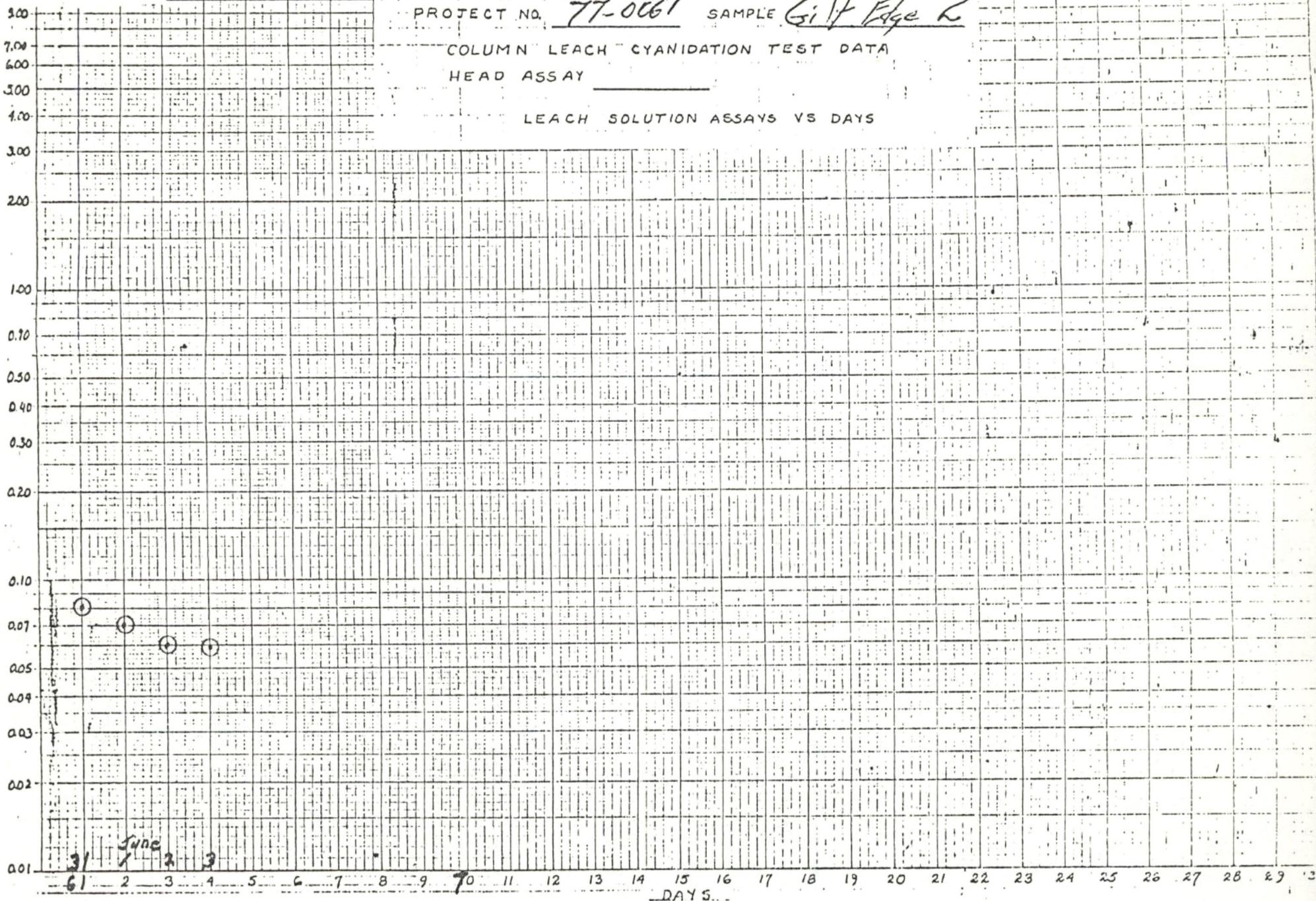
CYPRUS

PROJECT NO. 77-0061 SAMPLE Gilt Edge 2

COLUMN LEACH - CYANIDATION TEST DATA
HEAD ASSAY _____

LEACH SOLUTION ASSAYS VS DAYS

LEACH SOLUTION ASSAYS - G/L Au



CYPRUS RESEARCH COMPANY

Our Reference: 77-0061
 Your Reference: Develop 002

TO	REPLY	
	COMMENT	
RETURN TO		
MAY - 3 1977		
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2	6	
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TO: J.E. Worthington

FROM: K.A. Narain

SUBJECT: Weekly Progress Report, Week Ending
 April 29, 1977

DATE: May 2, 1977

1. Attached graphs, illustrating solution assays against time, do indicate that after 26 days of cyanidation further leaching for GLE #1, GLE #3 and NU-M2 cannot be justified. Hence, these three columns, after being washed and drained were emptied on Friday 29th. Please note that cyanidation of GLE #2 is still progressing.

2. Tentative gold recoveries after 26 days of cyanidation appears to be

GLE # 1	57.7%
GLE # 3	99%+
NU-M2	67.3%

Tentative recoveries from GLE #2 after 30 days of cyanidation is being calculated to be 93.2%.

3. Reagent consumptions are shown below:

	<u>NaCN (lb/t)</u>	<u>CaO (lb/t)</u>
GLE #1 (after 26 days)	4.63	1.51
GLE #2 (after 26 days)	5.56	3.87
GLE #3 (after 26 days)	4.90	0.79
NU-M 2 (after 30 days)	4.61	2.47

4. Two additional samples from the Haile prospect were received in the lab. Mineralogical investigation by Pat Colville has been completed and the report is attached. Samples are being staged grind to $\frac{1}{4}$ " size and it is anticipated that by Wednesday May 4, samples should be loaded in the column.

COLUMN LEACH TEST DATA

PROJECT NO: 77-0061 SAMPLE: Gilt Gulge #1 CHARGE: 29.74 Kg
DMU Unacidized

METALLURGICAL BALANCE:

PRODUCT	WEIGHT/VOLUME	AU ASSAY	CONTENT	DISTRIBUTION
PREGNANT SOLUTION				
LEACHED RESIDUE				

HEAD (CALCULATED):

HEAD (ASSAYED) : Gold - 0.042 oz/t Silver - trace
Hence, Gold in the loaded sample - 137.72 x 10⁻⁵ Troy oz.

REAGENT CONSUMPTION:

DATE	VOLUME LITRE	PH OF SOL.	SOLUTION ASSAY			AU RECVD TROY OZ	%EXTRCT. OF GOLD	CUMM EXTRN	REAGENT CONSUMPTION	
			AU	CN	CAO				CYANIDE	LIME
			<i>28.0g. of CaO</i>			<i>was added in the dry form</i>				<i>28.00</i>
3-30	5.46	12.60	-	-	626					<i>(-) 3.08</i>
			<i>CYANIDE WAS ADDED IN THE CIRCUIT</i>							
3-31	4.76	12.55	1.06	177	459	16.20×10^{-5}	11.76	11.76	3.27	<i>(-) 2.03</i>
4-1	5.94	11.99	1.22	301	197	23.26×10^{-5}	16.89	<i>28.65</i>	2.77	<i>(-) 1.13</i>
4-2	6.04	11.66	0.46	319	46	8.92×10^{-5}	6.48	35.13	2.63	<i>(-) 0.24</i>
4-3	5.96	11.38	0.24	389	9.0	4.59×10^{-5}	3.33	38.46	1.86	<i>(-) 0.01</i>
4-4	6.28	11.40	0.16	398	4.9	3.23×10^{-5}	2.35	40.81	1.86	<i>0.01</i>
4-5	6.10	11.25	0.14	372	4.9	2.74×10^{-5}	1.99	42.80	2.09	<i>0.01</i>
4-6	6.06	11.25	0.10	363	7.0	1.95×10^{-5}	1.42	44.22	2.17	<i>0</i>
4-7	7.40	11.14	0.08	372	7.8	1.90×10^{-5}	1.38	45.60	2.53	<i>(-) 0.02</i>
4-8	7.08	11.23	0.06	381	15.7	1.36×10^{-5}	0.99	46.59	2.31	<i>(-) 0.07</i>
4-9	8.10	11.21	0.06	363	12.2	1.56×10^{-5}	1.13	47.72	2.58	<i>(-) 0.05</i>

DATE	VOLUME LITRE	PH OF SOL.	SOLUTION ASSAY			AU RECVD TROY OZ	%EXTRACT. OF GOLD	CUMM EXTRN	REAGENT CYANIDE	CONSO TIME
			AU	CN	CAO					
4-10	6.00	11.08	0.06	354	11.6	1.16×10^{-5}	0.84	48.56	2.00	(-)0.03
4-11	7.20	10.93	0.06	292	10.7	1.39×10^{-5}	1.01	49.57	3.25	(-)0.03
4-12	6.10	10.85	0.06	274	9.6	1.17×10^{-5}	0.85	50.42	2.96	(-)0.02
4-13	6.58	10.80	0.05	301	7.3	1.06×10^{-5}	0.77	51.19	2.86	0.03
4-14	7.60	10.79	0.05	274	3.5	1.22×10^{-5}	0.89	52.08	3.69	0.07
4-15	6.06	10.75	0.05	292	3.8	0.97×10^{-5}	0.70	52.78	2.73	0.05
4-16	7.66	10.81	0.04	274	4.4	0.98×10^{-5}	0.71	53.49	3.72	0.11
4-17	5.44	10.76	0.04	257	2.6	0.70×10^{-5}	0.51	54.00	2.81	0.09
4-18	5.80	10.76	0.04	301	3.2	0.74×10^{-5}	0.54	54.54	2.52	0.09
4-19	6.00	10.74	0.04	301	2.9	0.77×10^{-5}	0.56	55.10	2.60	0.09
4-20	6.40	10.77	0.03	301	2.6	0.62×10^{-5}	0.45	55.55	2.78	0.10
4-21	6.15	10.78	0.03	301	2.6	0.59×10^{-5}	0.43	55.98	2.67	0.10
4-22	6.15	10.76	0.03	274	2.6	0.59×10^{-5}	0.43	56.41	2.98	0.10
4-23	6.10	10.80	0.03	274	2.6	0.59×10^{-5}	0.43	56.84	2.96	0.10
4-24	6.15	10.83	0.03	345	2.6	0.59×10^{-5}	0.43	57.27	2.16	0.10
4-25	6.48	10.95	0.03	363	2.3	0.62×10^{-5}	0.45	57.72	2.06	0.11

WASHING CYCLE STARTED FOLLOWED BY 12 HRS OF BRANLE

4-26

16

19.90

10.28

4-28

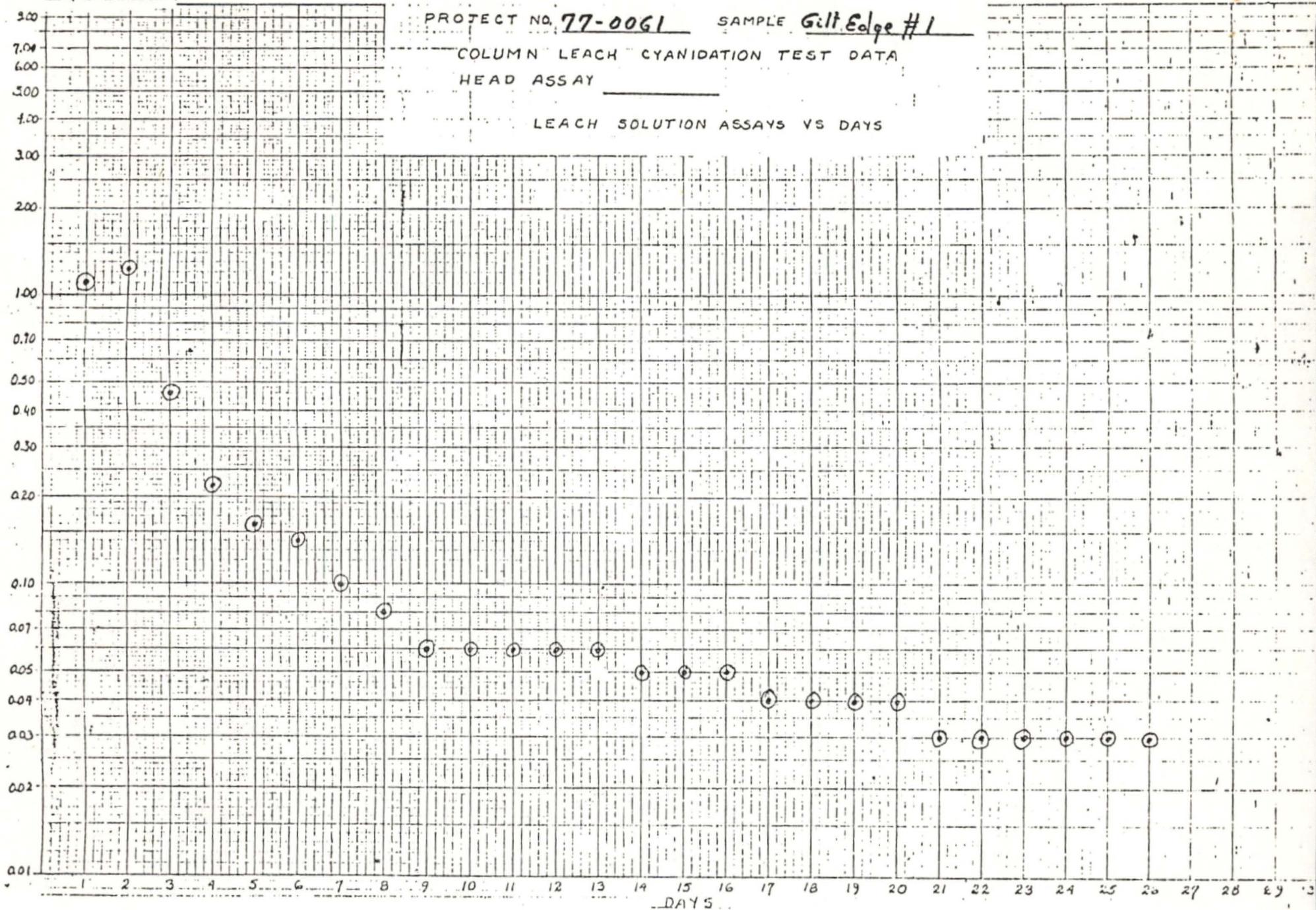
CYPRUS

PROJECT NO. 77-0061 SAMPLE Gilt Edge #1

COLUMN LEACH CYANIDATION TEST DATA
HEAD ASSAY

LEACH SOLUTION ASSAYS VS DAYS

LEACH SOLUTION ASSAYS - G/L AU



COLUMN LEACH TEST DATA

PROJECT NO: 77-0061 SAMPLE: Gilt Edge #3 CHARGE: 29.68 Kg.
53 Sunday Pit

METALLURGICAL BALANCE:

PRODUCT	WEIGHT/VOLUME	AU ASSAY	CONTENT	DISTRIBUTION
PREGNANT SOLUTION				
LEACHED RESIDUE				

HEAD (CALCULATED):

HEAD (ASSAYED) : Gold - 0.051 troy oz/t : Silver - trace.
** calculated from the Exploration's book*

Hence, Gold in the loaded sample = 166.89×10^{-5} troy ozs.

REAGENT CONSUMPTION:

DATE	VOLUME LITRE	PH OF SOL.	SOLUTION ASSAY			AU RECVD TROY OZS	%EXTRCT. OF GOLD	CUMM EXTRN	REAGENT CONSUMED	
			AU	CN	CAO				CYANIDE	LIME
			10.0g of CaO			loaded in	dry form			10.0
3-30	6.04	9.91	-	-	123					(-) 0.36
			CYANIDE ADDED IN THE CIRCUIT							
3-31	5.86	10.31	2.34	155	99	44.02	26.38	26.38	4.15	(-) 0.40
4-1	7.30	10.77	1.90	310	52	44.52	26.68	53.06	3.04	(-) 0.15
4-2	7.32	11.03	0.78	350	417	18.33	10.98	64.04	2.50	0.10
4-3	7.30	11.04	0.44	398	4.1	10.31	6.18	70.22	1.84	0.06
4-4	7.74	11.00	0.32	398	3.8	7.95	4.76	74.98	1.95	0.07
4-5	7.50	10.94	0.26	372	6.4	6.26	3.75	78.73	2.26	0.05
4-6	7.40	10.90	0.20	363	5.2	4.75	2.85	81.58	2.35	0.05
4-7	7.76	10.90	0.16	372	6.7	3.99	2.39	83.97	2.34	0.04
4-8	7.30	10.95	0.14	381	6.1	3.28	1.97	85.94	2.07	0.05

CYPRUS

PROJECT NO. 77-0061

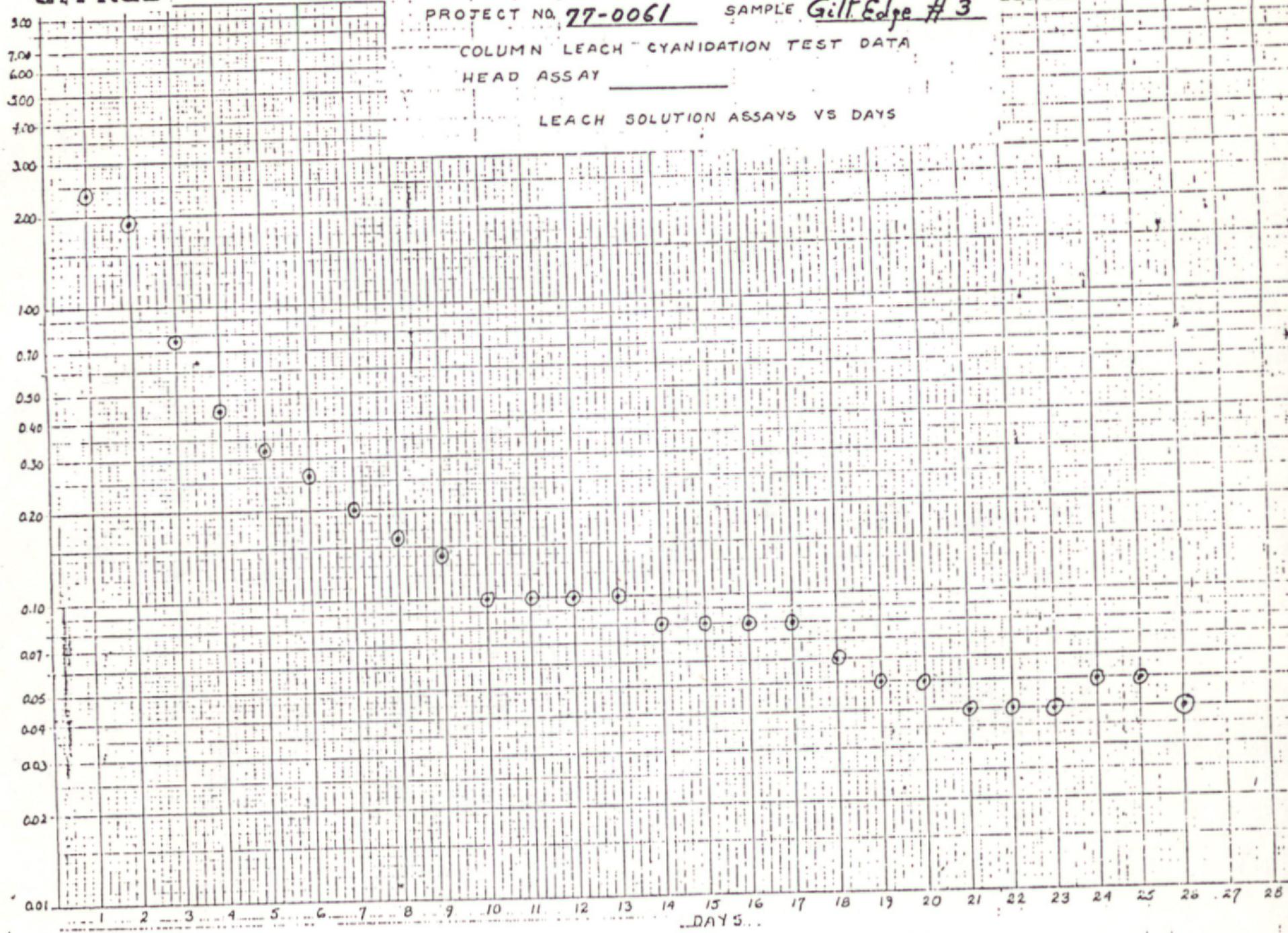
SAMPLE Gilt Edge #3

COLUMN LEACH CYANIDATION TEST DATA

HEAD ASSAY _____

LEACH SOLUTION ASSAYS VS DAYS

LEACH SOLUTION ASSAYS - G/L Au



We do not yet have results from Gilt Edge. Only have Northumbria. Co.

Joe W
Results check Leaching

To

A. A. Bakewell

March 28, 1977

From

E. S. Allen

Subject

Cyprus Research Company
Cursory Mineralogical Observations
Gilt Edge Samples for Column Leaching

Attached hereto are two (2) copies of Pat Colville's mineralogical observations of Gilt Edge Sample No. 1 - DMU Unoxidized, Sample No. 3 - S3 Sunday Pit and Sample No. 2 - DMO Oxidized.

These observations are made prior to commencing bench scale column leaching tests for precautionary reasons.

E. S. Allen

ESA/dt
Attachments (2)

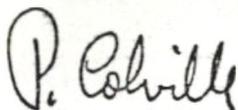
CYPRUS RESEARCH COMPANY

TO: Kartik Narain
FROM: P. Colville
SUBJECT: Gilt Edge Composites for Column Leaching
DATE: March 23, 1977

Three samples of Core Composite were examined for mineralogy with the intention of searching for compounds which could interfere with the cyanidation processes or characteristics that could create problems in heap leaching.

Unoxidized pyrite is found in the best oxidized samples whenever it has been protected by encasement. Sample two contains dike rock substantially altered to Montmorillonite.

Sample descriptions are attached.



P. COLVILLE
PC/bb

Encl as

GILT EDGE #1 DMU - Unoxidized GE-12-260-280,380-410
GE-13 80-120,130-140

Grey granite porphyry - fractured and vuggy.

Pyrite occurs disseminated in the granite, quartz and feldspar matrix but not within the large K-feldspar phenocrysts. Concentrations of large euhedral pyrite crystals (up to 2 mm) occur in vugs and veins.

Partial oxidation is confined to larger veins and fractures. This has resulted in short range staining with most of the pyrite still visible. Even the few areas that looked thoroughly oxidized on the surface proved to have considerable fresh pyrite beneath the stain. No evidence of kaolinization was found in these samples.

The sugary texture, fractures and vuggy structures in this rock should help to uncover the surface gold, but without fine crushing most of the gold will not be accessible to the cyanide solution.

GILT EDGE # 3 S3 Sunday Pit, GE-15 170-210
GE-16 200-240

Thoroughly altered partially crushed granite porphyry. The rock has become porous from the removal of the Fe sulfide. The remaining granite rock is stained pink but has not been significantly softened and altered to kaolinite. There are only a few accumulations of Fe oxides, hematite, goethite. There is a trace of lepidocrocite but very little jarosite.

All of this means that this sample has been flushed clean of sulfide and sulfate. The gold should be liberated and the alkali demand low.

Although 95% of this rock is porous but not soft, two minor types of rock were examined in more detail.

- 1. Some areas of the porous granite were easily broken. They were found to contain minor kaolin, trace mica and montmorillonite. (Major K-feldspar and quartz). The clay fraction did not easily slake and disperse in water so it is not expected to create any problems.
- 2. A highly oxidized one inch zone was broken open and residual pyrite cores were found in the hematite. Some kaolinite and gypsum were present. Only the cores of the largest pockets of pyrite will be resistant to cyanidation.

GILT EDGE # 2 DMO oxidized GE 13 20-30, 160-170
GE 14 12-80, 160-170

About 10% of this rock is unoxidized granite porphyry with disseminated pyrite like Gilt Edge #1.

Another 10% is dark green brown dike rock. This rock is currently composed of highly expansive montmorillonite with minor quartz and mica. It is heavily loaded with unaltered pyrite.

The remaining 80% of the rock could be divided into three categories all of which are fractured and well oxidized

- 1. Most of the rock is typical Gilt Edge granite porphyry, altered to a characteristic porous stained condition and containing small amounts of kaolin.
- 2. A small amount of extremely hard, fine grained rock composed of quartz and K-feldspar. This rock contains only traces of kaolin and pyrite appears to have been absent in this intrusive.
- 3. A dense glassy rock, highly stained, and apparently altered was x-rayed and found to contain montmorillonite and cristobalite with very minor quartz feldspar and mica. This type may have been a rhyotite intrusive.

A surprising amount of montmorillonite is found in this composite. Fortunately it is bound and not easily removed as is. Grinding and soaking this rock will certainly loosen some of it. The column should be watched for late clogging.